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ABSTRACT

A management information system (MIS) is embedded in the management and operating system of the organization. An MIS exists to provide information for management and operating purposes. The MIS must meet the information needs of management and operating users. The MIS consists of two components--a processor and a data base. Packaged systems have gained a strong foothold, but users are often not sure enough of their needs to take control of their MIS's and many are not "systems oriented." To get help in systems design and interpretation of information often raises organizational and resource issues that are not easily resolved. Thus, users will need to make a concerted effort to move MIS forward. (Author/KE)

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Management Information Systems for
Colleges and Universities
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ABSTRACT

The MIS concept is catching on in institutions of higher education, but there is still much confusion about what constitutes an MIS. This paper attempts to provide some clarification by providing an MIS conceptual framework for colleges and universities, and by discussing some current issues in relation to that framework. The MIS framework is based on the idea that an MIS is an embedded subsystem of the management and operating system of an institution, which exists to provide information for operating and management users. The MIS is further developed in terms of both processing systems and database definitions. Based on this framework, the current status of MIS in higher education is discussed. Finally, several suggestions for future MIS development are made.

INTRODUCTION

The idea of a management information system (MIS) has gained popularity in many profit and nonprofit organizations. Yet, a clear understanding is lacking of what constitutes an MIS, particularly as it relates to colleges and universities. Part of the confusion can be attributed to the recent emergence of the MIS concept and part can be attributed to the lack of application of MIS concepts to specific college and university situations.

At the present time, three erroneous approaches are being practiced under the banner of MIS in higher education.

1. Integrated Database Approach -- The practitioners of this approach focus on the integration of data and the database concept as the key to an MIS. The thrust is to make data readily available through database management systems, and in many cases, through online retrieval systems. An example of extensive concentration on database development and online retrieval is Project INFO at Stanford University [12].
2. Service Bureau Approach -- The practitioners of this approach take a service bureau attitude toward MIS. The burden of stating information needs rests entirely with the users. Such an MIS attempts to meet management needs for information as demands unfold. MIS planning is lacking; users with the most influence typically get the best service.
3. Off-the-Shelf Approach -- Practitioners of this approach try to develop an MIS by relying primarily on off-the-shelf software without serious examination of their own information needs. Examples of off-the-shelf software packages are the NCHEMS[1] RRPM system [4]; and

[1]The National Center for Higher Education Management Systems, Boulder, Colorado.

the CAMPUS system [14]. Both of these systems provide historical and projected costing for purposes of resource allocation decisions. Such approaches tend to be inflexible, and the system outputs may not meet management's internal needs for information.

All of the above approaches have one fatal flaw; they focus on the wrong thing. The primary focus in MIS development should be placed on management's need for information. The second approach comes closest to the proper emphasis, but it places the burden of defining information needs and system relationships entirely on management. The first approach places emphasis on integration of data and sophisticated data management software. The third approach places the emphasis for defining management information needs on the outside developer of the software package.

We believe the correct view of a management information system is as part of the larger management and operational system of the organization. The information provided by such a system should connect the various management functions and operations of the organization in a network like fashion. When viewed in this way, an MIS becomes an embedded subsystem of the organization's management and operating systems [2]. Such an MIS should be designed to meet the information needs for management and operating purposes.

Starting from the above MIS orientation, this paper develops a conceptual framework for thinking about MIS in institutions of higher education. Some recent developments in MIS are related to the framework, and the framework is used to discuss current issues affecting MIS in higher education.

There seems to be a bandwagon effect for MIS in higher education much like the trend that swept businesses in the 1960's. This has probably led to the three erroneous approaches already described in an effort to get MIS going. It is time for administrators and systems designers alike to begin to think more deeply about

MIS. Development of a conceptual framework which applies to higher education institutions is a necessary first step in this process. This framework should help dispel some of the confusion, or at least lead to a dialogue, over what MIS should be. It can also help an institution to evaluate its current MIS and to develop plans for MIS improvement.

Conceptual MIS frameworks have been developed for other organizations, most notably, businesses [2], [5], and [6]. But none has been developed, to the author's knowledge, for institutions of higher education. There is by no means a consensus on what constitutes an MIS in general, although a central tendancy of thought is emerging [8], [10], and [11]. The framework proposed here encompasses many of the central ideas in MIS and applies them to higher education.

GENERAL MIS CONCEPTS

Before developing the MIS framework, a few general MIS concepts will be presented. These ideas will form a basis for formulating more specific definitions with respect to colleges and universities.

The word MIS has been defined in many different ways. A relatively simple definition is as follows:

> An MIS is an embedded subsystem of the management and operating system of an organization, that provides information for management and operating purposes.

The definition emphasizes two important ideas. First, an MIS is embedded in the management and operating system of the organization. Development of an MIS must, therefore, be in harmony with the larger management and operating system. Secondly, an MIS exists to provide information for management and operating purposes. In doing so, the MIS must meet the information needs of management and operating users.

The definition of an MIS is further amplified by Figure 1. The MIS consists of two components -- a processor and a database. The MIS records data in the form of transactions from the environment and from the operations of the organization. It processes this data, with the aid of the database, and provides an information output to users. The users in turn may further process (or analyze) the information, and they may acquire other information directly from outside the MIS, which results in actions by the users. Effects of these actions are at some later time recorded on the input side of the MIS, and the cycle repeats.

Figure 1 reinforces the view that an MIS is part of a larger management and operating system. The MIS furnishes one form of input information to users, not the only input information. The information input provided by the MIS should meet the needs of the users and it should influence the actions of the users.

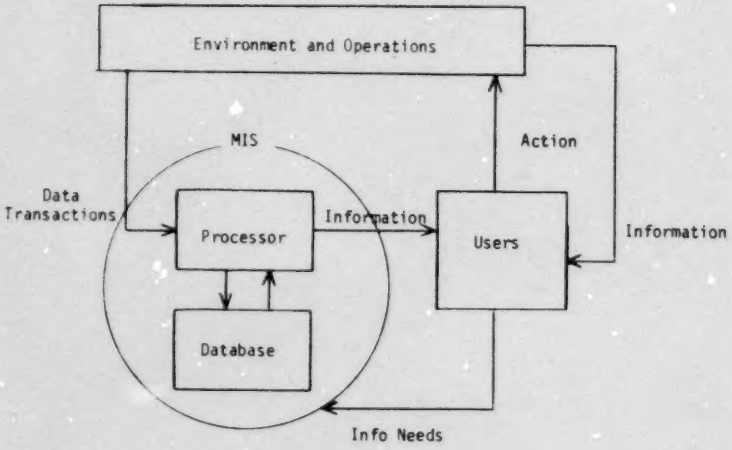

Figure 1

Broad-View MIS Schematic

MIS DESCRIPTION FOR COLLEGES AND UNIVERSITIES

In extending the general MIS concepts to colleges and universities, or any organization for that matter, the place to start is to define in more detail the characteristics of the processor and the database. In other words, we want to expand the circle shown in Figure 1.

There is a general tendancy in the MIS field to describe MIS processors in terms of operating functions and management activities. This approach seems appropriate for higher education as well.

Management activities are defined by Anthony [1] in three categories as follows:

1. "Strategic planning is the process of deciding on objectives of the organization, on changes in these objectives, on the resources used to attain these objectives, and on the policies that are to govern the acquisition, use, and disposition of these resources."

2. "Management control is the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives."

3. "Operational control is the process of assuring that specific tasks are carried out effectively and efficiently."

These categories are defined in this particular way so that the information utilized and management activities within a category are quite similar, but they differ greatly between categories. This allows one to draw useful generalizations about a particular category.

Strategic planning decisions tend to be unstructured and irregular; each problem is different. In higher education strategic decisions are made by faculty, students, and various levels of administration. The information utilized is not usually defined in advance; it is highly aggregated, and often must be interpreted by an analyst. The result of strategic planning is decisions and policies which set the direction for the organization and constrain management control activities.

Management control decisions tend to be structured and rhythmic. These decisions are usually made by both top and middle administrators. Many management control decisions are related to budgeting and include planning as well as control dimensions. The information utilized relates plans to actual accomplishments and it assists in choices between alternatives. The result of management control decisions is resource assignments and decision rules for use by the operational control level.

Operational control decisions deal with the execution of specific tasks. Some tasks may be completely programmed by specified rules; others may require human judgement in their execution. Operational control decisions in higher education are made by first-line supervisors, faculty, chairpersons, and even middle and top administrators. The information utilized tends to be transaction oriented (raw data). The result of operational control decisions is action.

Figure 2 indicates some examples of decisions in each of the three categories for institutions of higher education. The Figure should aid one in understanding the major differences between these categories.

As indicated above, the participative nature of higher education decision making combines a large number of users at all three levels of decision making. No one level is the domain of any one group of individuals. This often presents a problem in identifying an explicit decision process and the associated information needs.

A second dimension for defining an MIS is the operating function dimension. In defining an MIS as part of a larger management and operating system, the place to start is with the operations themselves. In trying to divide the operation into parts, it is necessary to define functions that are operationally different. Such a division will be similar, but not identical, to a division along organizational lines, since organizations are usually functionally divided.

Strategic Planning

Choosing mission, goals, and objectives

Deciding on organizational structure

Acquisition of major facilities

Starting new majors/degrees or dropping existing majors/degrees

Establish policies or strategies relating to academic programs, support services, student services, personnel, facilities, and financing

Gross resource allocation (budgeting) to organizational units and programs

Management Control

Formulation and control of detailed budgets

Planning and controlling personnel levels

Deciding on curriculum changes

Hiring of faculty and staff

Formulating operating procedures and practices

Measuring, appraising, and improving personnel performance

Operational Control

Scheduling of classes

Assignment of faculty to classes and other activities

Scheduling rooms

Controlling student registration, grades and graduation

Implementing admissions rules

Implementing policies

Scheduling and assignment of staff

Figure 2

Examples of Management Activities for Universities and Colleges

The operating functions of a university or a stand-alone college may be thought of as follows:

a. Academic
b. Student Services
c. Support Services
d. Finance
e. Personnel
f. Facilities

This list will, of course, vary from one institution to another, and it is only intended to be suggestive of the main functions performed. The functions will be somewhat different for a college that is part of a university, but the same concept could be followed to arrive at a suitable list.

To obtain a useful classification system, one will need to divide the above six functions into at least one more level of subfunctions. This subdivision may also vary from one organization to another, but a typical subdivision is shown in Figure 3. Since the functions are quite well understood, further detail is not presented here.

Combining the functions with the management activities, one obtains a matrix form of MIS. A similar form is discussed by Davis [5] for business organizations. This matrix classification scheme applies not only to types of decisions, but to types of information, and to some extent to types of processing subsystems (software). In the case of decisions and information types, most of them fall into one category of function and management activity. However, processing systems sometimes cut across functions and activities. For example, a change in faculty status may impact on personnel, finance and academic processing systems, and data files.

To this point we have been discussing the processor part of an MIS and how it may be subdivided into operating functions and management activities. We turn now to the database component of an MIS.

Academic

- Instruction
- Research
- Public Service
- Libraries
- Other Academic Services

Student Services

- Admissions
- Financial Aid
- Registration
- Housing
- Placement
- Alumni

Support Services

- Computing
- Plant Services
- Development
- Auxillary Enterprises
- Other Support

Financial

- Finance
- Accounting

Personnel

Facilities

Figure 3

Examples of Operating Functions and Subfunctions

A data bank may contain both common data and unique files. Some data may be placed in a common database to eliminate storage redundancies for data that is used in several different processing applications. Other data is unique; it is used for only one processing subsystem. Thus, we view the database as consisting of some unique files plus a common database.

Data that is used at different management activity levels, may be aggregated, classified, and interrelated in different forms. For example, the operational control level may utilize transactional data on individual student registrations. The management control level might utilize the number of students in a course, but never refer to the individual student. The strategic planning level may only deal with aggregations of courses, never individual courses or individual students. These different aggregations of student information may be stored in different databases. In the above example, there is no need to have access to the individual student registration database when dealing with strategic planning or managerial control processing. Thus, a series of common and unique databases could be created for different management activity levels. On the other hand, all these levels of data may be stored in one huge database, if it is more efficient to do so. The choice depends on the circumstances of each case.

Putting together the processing system and database concepts discussed above, we obtain the view of MIS, shown in Figure 4. It consists of processing systems and processing outputs classified by management activity and operational function, plus a series of common and unique databases also classified by management activity and operational function. Integration is achieved through the common databases and through some of the processing subsystems.

This completes our discussion of the MIS conceptual framework. We turn next to some current developments and issues that are described in terms of the proposed framework.

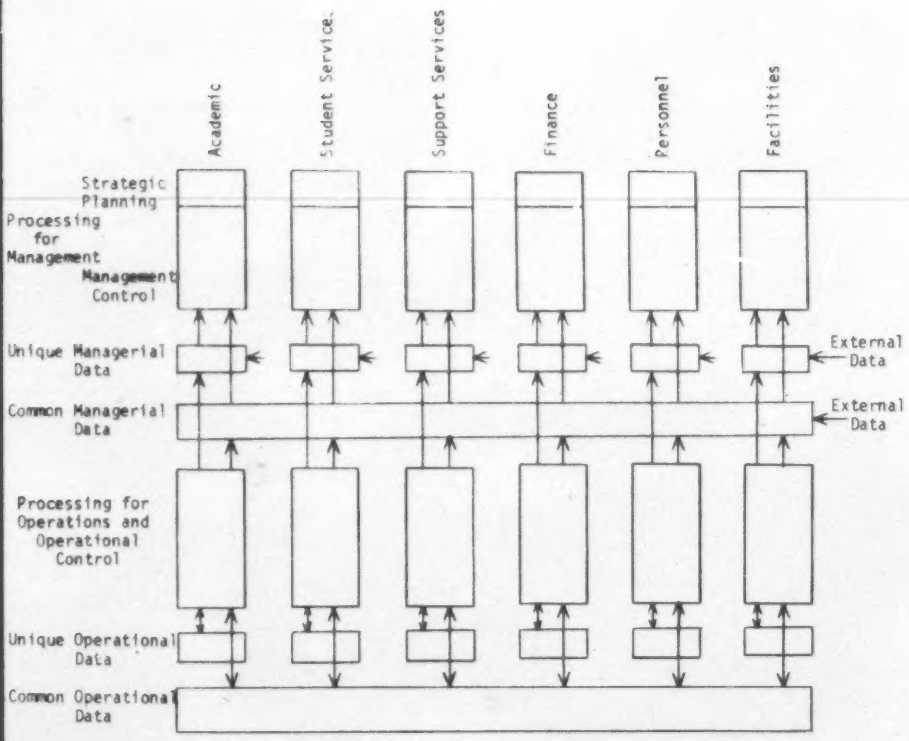

Figure 4

MIS Framework for Colleges and Universities

DISCUSSION OF MIS

The status of MIS in institutions of higher education can be readily discussed by using the MIS framework. The first step in this discussion is to indicate the types of systems that are available.

Figure 5 illustrates systems that are commonly available either through CAUSE[1] or through software vendors. The Figure is only illustrative; there are many more systems that have been developed within individual institutions. Several interesting points can be drawn from Figure 5.

First, most of the systems available tend to be of the operations or operational control type. Very few systems are available for the managerial control or strategic planning functions. This is particularily true in the areas of student services and personnel.

Secondly, the trend seems to be toward the use of off-the-shelf costing packages such as RRPM, SEARCH, or CAMPUS. It is doubtful whether these off-the-shelf systems will be successfully used, unless they meet a predetermined need for information. Users must recognize that they should help define information needs and that needs should be defined before systems are purchased. If this approach is used, it is likely that many more tailor-made costing packages will be developed to meet internal needs for cost information [7].

Thirdly, in the management control and strategic planning area, the systems available are mostly costing oriented. There is also a need for systems that deal with output information, student information, and environmental data. Examples of decision problems are listed in Figure 2 that require non-cost information. A system for resource allocation that includes both cost and non-cost is described in [12].

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[1]College and University Systems Exchange.

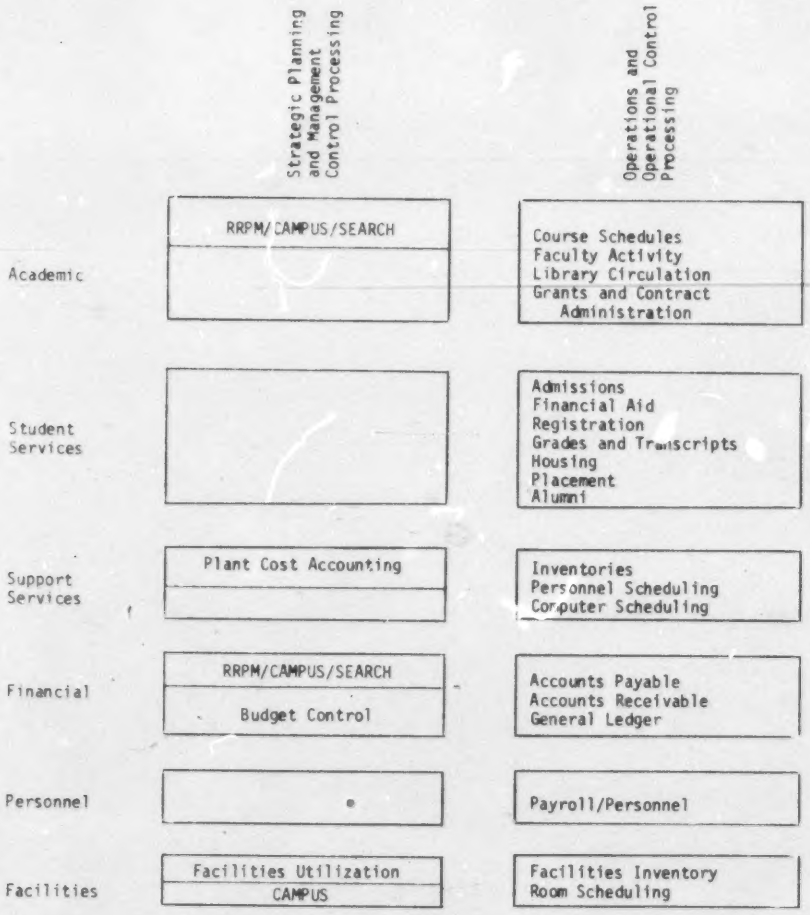

Figure 5

Illustrations of Systems Available

Finally, the framework is helpful in discussing the whole question of information needs, which is a pressing problem in MIS in general, as well as in higher education. The conventional wisdom, supported by some evidence as well [9], suggests that information needs should be determined by a user/analyst combination. An analyst typically has insufficient knowledge of the decision process to specify information needs on his own. The users are generally not well enough versed in the kinds of information that can be produced to specify needs on their own. Therefore, a combination of users who understand the decision process and analysts who understand the technology is a preferred approach to the information needs problem.

However, this is easier said than done. Often the user/analyst combination does not really work as a team, with either the users or analysts taking a dominant role. In higher education this is compounded by the multiple user problem. The result is that information produced may not really meet the needs of the users.

A second difficulty in specifying information needs is that decision processes are often ill defined or constantly changing. This is especially true in the strategic planning area. Therefore, one must expect to use an analyst or interpreter between the user and the information system [15]. Strategic planning data will almost always have to be fitted to the decision problem at hand and interpreted by a staff person who has time to structure and explore the problem.

What then should be done for the future?

First, users should concentrate on internally specified information systems that meet their needs. Users should, of course, consider existing or packaged systems and use them when appropriate. But, the definition of information needs and decision making systems should come first -- not the packaged system.

Secondly, users should obtain access to qualified systems designers, either as part of their own staff or in cooperation with the data processing department.

These systems designers should be competent in administrative concepts as well as in computer technology. They should be responsible to the user for helping to define what types of systems are needed, as well as defining the systems requirements for specific needs.

Thirdly, users must be involved in information systems design themselves. They should take the time to learn about systems that are available, to study administrative concepts, and to work with systems designers in defining information needs. Users cannot rely on systems designers to know what is needed. Unfortunately, systems design has not progressed to that state. A good case for executive involvement in MIS is made in [3].

Fourth, Users should develop an analytic support capability in their organizations, in addition to information systems, on the assumption that a portion of management information will have to be processed by humans after it comes from the MIS. Interpreters of information will have to be recruited and trained to perform this analytic task. Often this function is labeled institutional research.

Fifth and finally, an MIS master plan should be developed. The plan should serve to define what is meant by MIS at an institution and it should help resolve important issues such as those suggested above. This plan should specify the types of systems and databases to be developed and their relative priorities. The framework presented in this paper can be used to think about systems that might be developed. The development of such a master plan will also provide an opportunity for user involvement; it will highlight the need for systems analyst input; and it should help place the focus on information needs rather than on packaged systems. The lack of such a master plan can lead to a confused picture for MIS.

By taking the above five steps, users will insure the maximum potential for MIS success. However, it will not be easy to take these steps. Packaged systems

have gained a strong foothold; users are not sure enough of their needs to take control of their MIS's, and many users are not "systems oriented." To get help in systems design and interpretation of information often raises organizational and resource issues that are not easily resolved. Thus, users will need to make a concerted effort to move MIS forward. It is only through user effort that MIS's will be improved in colleges and universities.

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